DOCUMENT RESUME

ED 427 770 IR 019 425

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TITLE Challenges and Problems in Designing and Researching Distance Learning Environments and Communities.
PUB DATE 1998-00-00
NOTE 22p.; Paper presented at the Malaysian Educational Research Association (MERA) Conference (1st, Penang, Malaysia, April 28-30, 1998).
PUB TYPE Reports - Descriptive (141) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Computer Mediated Communication; Computer Networks; *Computer Simulation; *Distance Education; Educational Research; *Educational Technology; Foreign Countries; Higher Education; Instructional Design; Internet; *Online Systems; Research and Development
IDENTIFIERS Technology Integration

ABSTRACT

The challenges and problems in both designing and conducting research on distance learning courses are considered in light of the present cyberspace revolution. This paper discusses: the future possibilities of Internet-based learning; assumptions of online courses which are usually embedded in constructivist and socio-constructivist theories and principles; differing presuppositions underlying Western and Eastern cultures; communication as a process of interpretation; possibilities of computer simulations; and the impact of the new technologies on the educational research community. Also described are examples from Singapore of online educational communities. Recommendations for online instructional design and future research are also provided. (AEF)

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Paper presented at the

1st Malaysian Educational Research Association (MERA) Conference

28-30 April 1998 (Penang, Malaysia)

Challenges and Problems in Designing and Researching Distance Learning Environments and Communities

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Abstract

The tremendous power and potential of the electronic communications technologies are shaping people now and will continue to shape their conceptions of self and of reality, and the educational process in the future. However, the introduction of information technology does not necessarily ensure its meaningful pedagogical use. Aside from technical limitations in designing and implementing distance learning courses there are a number of pedagogical conceptual issues to do with the experientially based nature of learning, and the role of language and culture that need to be explored. In addition the full impact of electronic networking on the educational research community in redefining conventional patterns of research is only beginning to be realised. The challenges and problems in both designing and doing research on distance learning courses are considered in the midst of the present cyberspace revolution.

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Introduction

Technological advances have blurred the distinction between traditional and modern education settings, the role of teachers and students, experts and novices, as well as our conceptions of self, our understanding of **reality**, and the way **real** life problems are solved. They have stimulated a re-evaluation of our identities, and a review of the purposes and content of education, the learning about computers and the communication networks, even the research to be designed and done online electronically-speaking.

A great number of thinkers, educators, psychologists, sociologists and technologist have written about the above phenomenon. Sherry Turkle, a professor of science at MIT tells the story of the changing impact of the computer on our psychological lives and our evolving ideas about minds, bodies and machines. What is emerging, Turkle says, is a new sense of identity - as decentered and multiple (Turkle, 1995:180). The idea of the computer as a calculator has become quaint. People no longer learn about calculations and rules on the computers. They move in environments that simulate real people, and objects, navigate through imaginary space and virtual locations and interact and exchange views with experts and other personae in cyberspace. McIsaac and Gunawardena (1996: 4) describe the situation in the following words:

> As traditional education integrates the use of interactive, multimedia technologies to enhance individual learning, the role of the teacher changes from knowledge source to knowledge facilitator. As networks become available in schools and homes to encourage individuals to become their own knowledge navigators, the structure of education will change and the need for separate theories for distance education will blend into the theoretical foundations for the mainstream of education.

Connick (1997:9) sums up the situation thus:

> ...The new culture is based on the power and the dynamic nature of information technology and telecommunications, which, combined, allow us to deliver education anywhere, at any time, to anyone who needs it.

Around the world, distance learning over the Internet or by other communication and information technology means is growing at an astonishing pace. As the use of

telematics in education grows the question arises as to whether there are inherent limitations to the use of such an approach – should a course be delivered entirely via the Internet? The Internet, particularly the World Wide Web, also raises a number of issues for the educational research community with regard to the move from traditional to information technology-assisted information skills, collaboration on research projects, materials available for research on the Internet, and the interchange of ideas within a 'new' intellectual community present on the Internet (Chronaki and Bourdakis, 1996).

The World Wide Web is an Internet-based hypermedia initiative for global information sharing, and is the incarnation of the concept of cyberspace. One interpretation of what is meant by the term 'cyberspace' is that it involves the limitations of space. The information and communications revolutions that have resulted in the Internet have built a means of information exchange which has 'annihilated' distance and time, and accelerated the process of perhaps creating a global community of inquiry (Thornburg, 1994; Silvio, 1995). In wandering in the multidimensional virtual world of cyberspace, people are navigating through a 'mental geography' or mental landscape. However some questions that will be discussed relate to whether people situated in different cultures and are of different educational backgrounds, age and gender, are moving through the same mental landscape.

The promises for distance learning

The future for interactive distance learning lies in the much hailed electronic networks in which there is:

> ...a seamless networked learning environment that integrates voice, video, and data connections among learners, instructors, experts, virtual libraries, the Internet, and support services. At the center is the distance learner, connected with both real-time and non-real-time links to these resources.
> Chute et al. (1997: 75)

Chute *et al.* (1997: 76) , in addition, usefully summarise the two types of communication technologies used in electronic networks:

> *Synchronous* communication technologies, such as desktop video teleconferencing and interactive group video teleconferencing, enable live, real-time interaction between instructors and learners. Instructors, subject mater experts, and learners see and hear one another at all sites and engage in interaction similar to face-to-face classroom interaction. *Asynchronous* communication technologies, such as e-mail, multimedia databases, virtual libraries, and the Internet, support non-real-time interactions and access to vast information resources at a time and place convenient to learners.

This change in the educational process, however has not really occurred throughout the whole world and among all users of computers. In most instances, courses designed for virtual learning either at home or at a distance over the Internet or by other telecommunication means have problems in engaging the learners to solve real life problems in simulated learning environments. The inherent limitations to the use of such an approach are the issues of accessibility, inter-connectivity, interactivity, immediacy, and integration – the very same features that are often highlighted as promises of the Internet and other electronic online learning environments.

It is important not to be overwhelmed by the associated technologies on the Internet and to realise that despite its potential, its use does not necessarily lead to more effective teaching or learning. There are significant, critical differences in the various ways technology can be used for distance learning. Many of those differences can be traced to the theories of learning and teaching that were used in the design and development of the tele-lessons or courses. But there are other differences arising from the interpretation of the intent of those lessons and courses due to differences between Western and Eastern cultural and philosophical traditions as well as their experiences of virtual environments. The total impact of such experiences often change our notions of self, others, machine and the world. This in turn shapes our online learning and research.

Psychology of learning embedded in the design of distance instruction

Whilst recognising the importance of learning theories in the design and use of distance learning lessons and courses, this paper will focus more on the cultural and language differences that have been highlighted by Lev Vygotsky in shaping human learning. First, a review of the assumptions of online courses which are usually embedded within constructivist and socio-constructivist theories and principles.

Though there are considerable overlap between the two constructivist theories, the following statements developed by John Bransford and his colleagues at Vanderbilt University (the Cognition and Technology Group -GTGV, 1993) summarise Vygotsky's pedagogical principles that are being incorporated into the design and use of the tele- or online courses:

1. Learning and development is a social and collaborative activity.
2. The Zone of Proximal Development (ZDP) can serve as a guide for curricular and lesson planning.
3. School learning should occur in a meaningful context.
4. Relate out -of-school experiences to the child's school experiences.

Based on these principles, a number of tele-courses using a variety of communication technologies have been designed and developed in the West and in Singapore recently. The emphases on active participation in ***real life*** learning situations by synchronous or asynchronous communication technologies and interaction, immediacy in facilitating learning and apprenticeship, and relating "school learning" around the culture and experiences the learners already know and understand. Technology is expected to help accomplish the goals in several ways, essentially within a culture of simulation. However, - an understanding of the differing presupposition underlying Western and Eastern cultures is crucial before a link could be made to a proper understanding of an electronic culture of simulation.

Differing presuppositions underlying Western and Eastern cultures

An appreciation of the role of culture in education is essential as it leads educators to a deeper and more valid understanding of the nature and complexity of student learning (Watkins and Biggs, 1996). The anthropological conception of culture is not to think of, say, societies as having cultures in an object sense. Societies do not possess a culture, societies *are* cultures (Bate, 1994).

Particular cultures may have particular 'world views' or basic assumptions underlying them (Pepper, 1942). At the risk of stereotyping or over-generalising there are fundamental differences between 'Western' and 'Eastern' philosophical, religious and cultural traditions. Western culture's sense of reality, for instance, has been shaped to

a large extent by a mechanistic world view, a viewpoint which still dominates the school curriculum (Doll, 1989; Gough, 1989). Eastern culture's sense of reality seems to be more wholistic, a view that takes into consideration the interdependent relationship of living things and the environment, the natural and human elements, and their mutual shaping in meaning making. Cheng (1995: 17) in discussing the role of culture in education refers to the much discussed work by Hofstede (1980, 1991) contrasting the interplay between the individual and the community in American and Chinese cultures , and proceeds to argue that:

> ...the collectivistic characteristics of the East Asian societies have placed collective (and national) needs above individuals, hence creating a virtual but powerful common goal for achievements.

Williams-Green *et al.* (1997: 5) in reviewing the literature on the philosophical assumptions underlying various cultures conclude that there is:

> ...a general tendency of Western culture to value individualism, personal achievement, independence, human interactions that are functionally based and specialized, inalienable rights, and an emphasis on time and space systems. In contrast, the people with non-Western cultural orientations are portrayed as emphasizing group cooperation, affective expression, harmony with others and nature, holistic thinking, intuition, and contemplation.

Similarly Hansen (1991: 76) points out that there are fundamental differences between Western and Chinese theories of the nature of language:

> Western theories of language centrally employ philosophical concepts such as truth, belief, meaning, and propositional knowledge. The Chinese theory of language has no formally adequate counterparts of 'true', 'believes', 'knows that', or 'idea'. Western theory treats the function of language as descriptive or representative. Chinese theory treats the function of language as socializing, regulating, and co-ordinating behaviour.

In the field of medicine Wu (1991: 250) points out that underlying Western and Chinese medical traditions are two quite distinct perceptual frameworks even though both arise from studying the same human body:

> In Western medicine, distinct entities (organs, structures, performances) are measured quantitatively and analyzed linearly/causally, typical of separation-

> mentality; precision is important here. Chinese medicine is pattern-thinking, phenomena-discerning, and takes things as interpenetrative…Technical terms in the West are independently and precisely defined; words in China are adumbrative and contextual.

Metaphors or mental models form the basis for taken for granted assumptions about the world. For instance, there is a primacy of a metaphor of dualism in Western culture (Haste, 1993). The world is made sense of in terms of either/or, in terms of polarities (e.g. atomistic-holistic, linear logic-intuitive, harmony-mastery, rationality-intuition). Real change occurs when there is a profound change in the underlying metaphor of the nature of the world. If there is more than one valid alternative perspective, a monolithic or absolutist position is untenable. Metaphors provide models for explanation, and can transform meaning. The Western dualistic or common sense 'relative' world consists of a collection of discrete objects, interacting causally in space and time. In contrast, in a paper on *Nondual Thinking*, Loy (1986: 294) argues that much of Asian philosophy constitutes a radical critique of thinking as it is considered to usually occur:

> Another nonduality, the nondifference of subject and object, is a crucial - perhaps *the* crucial - concept for several of those Eastern systems which criticize reasoning/conceptualizing - particularly Mahayana Buddhism, Advaita Vedanta, and Taoism.

The implication is not that people in Asia think non-dualistically but that part of the Asian cultural tradition(s) are underlying systems of philosophy that are fundamentally different from the Western historical and philosophical tradition (Allinson, 1991). This, of course, has implications for communicating across cultures, and the process of designing virtual learning environments.

Communication as a process of interpretation

Real-time videoconferencing can provide virtual face-to-face inter-connectivity and interactivity, but still has a number of physical (and conceptual) constraints. Jacobs and Rodgers (1997) in describing the experience of a trans-Europe project involving the use of videoconferencing for remote interactive tutorials mention the constraint of the number of students that can be identified on a TV monitor, the quality of the video signal and the lack of perfect synchronisation between the sound and the speaker's

lips. Subtle facial and body gestures can be obscured in a videoconference link. The development of the above and future technologies is fuelled by a desire to ultimately develop and reproduce a true artificial or 'virtual reality' which can reproduce all five sensory modes (Russell, 1997). However it is not just the limitations of the existing communications technologies that can lead to misunderstandings, but the very nature of how concepts themselves are understood or constructed. Concepts exist within a web of meaning which is mediated by the cultures to which individuals belong.

The mutual sharing and comparing of experience between people is a matter of interpretation, not inference. Inference would involve a logical deduction, such as inferring that a wall has another side hidden from view. Interpretation is the process of determining the meaning of signs (e.g. words, gestures, facial expressions, tone of voice) that are present and encountered directly. In other words if communication is regarded as an exchange of ideas through the use of symbols, the symbols are not the words themselves but some elements of common human experiences with which the words are associated. Wittgenstein (1953) distinguishes between 'first language' which is essentially experiential and tacit, and 'second language' which is expressed through the translational medium of the first. The 'danger' of a culture of simulation lies in instructional designers overlooking the fact that meaning is not directly apprehended but is the result of meaning within a particular conceptual framework.

The individual makes sense of the world through both language and through the process of active interaction with other individuals. According to Dewey the form of experience that is most educative is participation in shared inquiry. It should also be borne in mind that since there is a distinction between knowledge of propositions (i.e. content) and knowledge of how to do things there will be some learning and skills that can not be taught at a distance.

The Internet is, arguably, one of the greatest resources ever invented for fostering growth as it 'represents a dynamically evolving virtual world, with virtual communities forming all over the place, each composed of people with similar interests but diverse locations' (Cunningham, 1996: 3). The theory of situated cognition suggests that learning should be viewed as a process of enculturation which occurs when individuals increase their participation in a community of practice

(Brown *et al,* 1988; Lave and Wenger, 1991). This echoes a point made by Dewey (1933) that the acquisition of knowledge is not a passive affair. Take the notion of 'filial piety' – knowledge of what filial piety is cannot be gained without actually practicing it.

In discussing the problem of interpreting across cultural boundaries Smith (1991: 28) points out that:

> In large scale cultural communication, however, involving long and complex philosophical and religious traditions, more formidable problems arise and the boundaries to be crossed are such that we can no longer safely assume the relatively simple one-to-one meaning equivalents that are the stock-in-trade of the professional interpreter.

Language is not 'just' a technical matter to be factored into the programme of instruction, it is an integral aspect of culture. Culture itself cannot be objectified as just another factor to be programmed into designing a distance learning course.

The importance of culture in the use of language and the role of metaphor, with respect to virtual environments, can be illustrated by a few examples. In China the concept of the 'computer' is expressed or translated as an 'electronic calculator'. This term carries with it connotations of the old Western conception of the computer. It connotes an operating system or a machine that operates in a quantifiable, observable or measurable way. In Hong Kong, Singapore and Taiwan, however, the concept of the 'computer' is expressed in Chinese symbols meaning 'electronic brain'. The latter expression for computer has connotations which denote greater flexibility and power. Similarly in Taiwan the concept of 'software' is expressed as meaning a 'soft piece'. In China the term used, means a 'soft organism'. The term used for software in China carries with it a greater suggestive or imaginative power. In Taiwan, the term for 'Internet' refers to 'the net within the web' while in China the term used, indicates a 'collaborative network'. The term used in China has a greater potential for indicating the power and usefulness of the Internet. The appropriate choice of metaphor underlying a particular concept has consequences for how a particular technology is perceived and therefore fruitfully used.

Possible consequences of a culture of simulation

There has been a paradigmatic cultural change in the understanding of computers from the early 'culture of calculation' to a 'culture of simulation':

> When I first studied programming at Harvard in 1978, the professor introduced the computer to the class by calling it a giant calculator.
> Turkle (1997: 76)

Computer simulations do enable students to think actively about complex phenomena as dynamical systems, and gain experience in manipulating a system whose underlying assumptions are not understood or even may not be true (Mellar *et al.*, 1994; Turkle, 1997). Microworlds, such as a collaborative computer simulation for exploring Newtonian physics (Cockburn and Greenberg, 1995), have been shown to be an intuitive appeal in promoting discovery and exploratory learning. The criticism often made is, of course, that students learn more about computer reality, but less about the 'real world'. Computer microworlds, however, are not 'passive' – they do more than transmit information. A key goal and challenge of virtual instruction is, therefore, that students become not just fluent users of simulations (i.e. the software and hardware), but also wise and apt in understanding the nature of simulation itself.

People invent technology, but then technology shapes us in turn. A similar sentiment was expressed by Marshall McLuhan in the 1960s when he coined the phrase: 'The medium is the message'. What he meant was that contrary to popular assumption communication networks are not transparent, in conveying messages the medium does shape the meaning of the message:

> Television is not a window on the world, it does not simply show the audience pictures of events that happen to be taking place elsewhere. Rather, it actually has a role in determining what the audiences see and how they make sense of it.
> Woolley (1992: 127)

Technology appears to make everything transparent and is usually regarded as being itself transparent and culturally neutral, but it is arguably both conveying and shaping private and public understanding. McIsaac (1993) points out that often media,

materials or services are inappropriately transferred without sufficient recognition of the recipient cultural setting.

The development of the printing press with Gutenberg resulted in a move from an oral to a written culture. The development of an electronic culture likewise will arguably have a transformative effect on both people and societies. Rud (1997: 30) summarises the argument of electronic mediated language leading to:

1. a form of language erosion due to the loss of subtle uses of language (e.g. irony) by the requirements of distant, easy and quick communication
2. a flattening of perspective due to a lack of a historical perspective
3. the diminishment of the private, interior self as individuals become part of a system that is transparent and where duration is replaced by instant.

Whether these predicted consequences will or do actually occur needs to be subjected to investigation by the educational research community, which itself is only beginning to come to terms with interactive, multimedia technologies.

Impact of the new technologies on the educational research community

The full impact of the convergence of communications and information technologies (e.g. the Internet) on the educational research community is only beginning to be realised. Young (1991: 1), for instance, suggests that:

> There is evidence that a restructuring of the knowledge communications infrastructure [as a result of electronic information] will have a fundamental impact on our educational, research, and informational institutions. It is affecting the communication customs, habits, and expectations of scholars, scientists, researchers, and academic librarians. In effect, the changes are affecting the entire information transfer cycle from the creation, structuring, and representation of information to its dissemination and use by the members of our collegial knowledge communities.

Electronic or e-mail is probably the first Internet resource that researchers come across, and has revolutionised communication processes by allowing users to receive and transmit information from virtually anywhere in the world almost instantly and at

relatively low cost. Sproull (1986: 159) lists four characteristics of e-mail that make it such a powerful tool:

- *Speed* - messages can be transmitted in seconds to any location in the world...
- *Asynchronous Communication* - messages can be sent, read, and replied to at the convenience of the user.
- *No Intermediaries* - Email messages are generally only read by the receiver.
- *Ephemerality* - Email messages appear on screen and can easily be deleted with no trace of a hard copy.

Apart from enhancing contacts between individuals and groups e-mail has been used in a variety of ways. The growth of online networks around the world, and increased access by individuals and institutions, for instance, has seen an increase in the use of e-mail survey research, i.e. the systematic data collection of information on a specific topic using computer questionnaires delivered to an online sample population. Thach (1995: 30) points out that there are many advantages to e-mail survey research over traditional paper questionnaires, but also some disadvantages:

> Some drawbacks include the sample demographic limitations, lower levels of confidentiality, additional orientation/instructions, layout and presentation issues, and potential technical problems with hardware and software. Advantages include cost-savings, ease of editing/analysis, faster transmission time, easy use of preletters (invitations), and the three major response findings: (1) higher response rates, (2) more candid responses, and (3) potentially quicker response time with wider magnitude of coverage.

After people discover e-mail, it is common for them to enter into the world of listservs or specialist discussions groups (see Pierce *et al.*, 1995; Pierce *et al.*, 1991). Pierce *et al.* (1994: 25) in discussing the use of electronic listservs and discussion groups quoted one subscriber who explained why he engaged in computer networking:

> I stumbled across a call for papers from someone who had proposed an invited symposium and needed a couple more presenters. Got a presentation and a trip to a conference that I didn't even know about before. I have had the opportunity to be a "peer reviewer" and a semiregular article reviewer for a journal by answering similar pleas for help from busy editors. On numerous occasions I have conducted "grapevine searches" on various e-mail lists to supplement my library-based literature searches. I've located interesting material in addition to meeting "kindred spirits" with similar research interests.

The development of electronic discussion lists and Web technology has resulted in the development of electronic journals. As Pierce *et al.* (1994: 27) point out the electronic journal can have a number of advantages over paper journals:

> The advantages of electronic distribution include reduced publication time, increased access, and potentially reduced costs. The contents can be searched with many word processors. Furthermore, with the on-line discussion capabilities of the network, greater peer review, comment, and interaction are possible in a timely manner. Innovative forms of peer review and feedback/exchange with the author would be possible (e.g., attached to each article could be the reviews of any reader wishing to comment, or a list of rebuttal comments, questions and responses by the author).

Electronic journals, of course, by their very ease of use raise questions of copyright protection, and the facilitation of plagiarism. Kriz (1995: 1) comments on publishing on the Web:

> The World Wide Web (WWW) is emerging as an elegant and usuable method for distributing information via computer networks. WWW uses interlinked hypertext documents to find and display multimedia information, including text, color graphics, video and audio. The Web can be used to distribute information within a company or university, to a small group of students in a particular class, or to the entire world. The means for doing this are now available to anyone with a desktop computer connected to a network.

The ease of publication is enhanced by software being freely available on the Internet, as is Web documentation and tutorials on creating hypertext multimedia documents (see Forsyth, 1996; Kriz, 1995). The sheer quantity of information available in cyberspace does raise the question of separating the Internet wheat from the chaff (Maddux, 1994)

Electronic networking is, consequently, also redefining conventional patterns of research. For instance, documents that had previously been stored in physical form are now retrievable by a number of users simultaneously and kept in cyberspace. The introduction of information technology does not, however, ensure its effective use. Teaching research students (and faculty staff) to use such new tools as networked computers and on-line databases is as essential today as were the skills of typing or

using a card catalogue in a previous era (Barry, 1996; Levy *et al.*, 1996). As Kawamoto (1994: 48) points out:

> If the vast amounts of information available on electronic databases lend themselves more to the metaphor of having to navigate through an ocean than a superhighway, computer-assisted research training is not ultimately concerned with what to fish, but rather *how* to fish.

One of the most exciting aspects of this communication revolution is how it facilitates collaboration or partnerships between researchers, not just within the same community but particularly across geographical boundaries, gender, age, ethnicity and disciplines (Gaines and Shaw, 1996). This can be clearly seen in the creation of chat groups, and MUDS and MOOS. The main characteristic of chat groups is the immediate transmission of typed messages between the members. It is a form of electronic dialogue. A MUD (multi-user Domain) is a software programme that accepts "connections" from multiple users across the Internet. A MOO is a MUD built using object-oriented technology that makes it easier for a learner to create new objects.

Two Singapore examples of MUDS and MOOS

In Singapore, the first MOO based on a virtual school in Singapore, called SkooWOO was launched in October, 1996 (Looi, 1997). Two other online learning communities have been created last year. The first is Science ALIVE, a project with the ten secondary schools which were chosen as the demonstration schools in the IT Masterplan in Education. In Science ALIVE students from different schools formed a project team to research on a science topic and published their findings as a virtual science exhibit. IT Instructors from the Educational Technology Division of the Ministry of Education provided facilitation for the project teams to work together. Content experts from the National Institute of Education, Nanyang Technological University, and the Singapore Science Centre were also involved to serve as science experts to guide and help the students. This community of students, teachers, IT instructors, content experts and technical experts interacted in face-to-face meetings as well as online using Space ALIVE. A offspring of the ScienceALIVE project is SpaceALIVE focussing on transportation. This on-going project involves students from schools in six SEAMEO countries: Brunei, Indonesia, Malaysia, Philippines,

Singapore, and Thailand doing research projects on transportation. Yet another online learning community is HistoryCity – a virtual community modelled on 1870s Singapore. Children could "make history" by being residents of the 1980s, collecting and trading period items and using them to create interactive dioramas. They could have access to many different parts of old Singapore, from Chinatown to Commercial Square to Little India.

These are simulated learning environments that have been specially prepared as R & D projects that are sensitive to the culture and language of the people of Singapore and Asia. Participants from Malaysia would enjoy the simulated environments because of the similar culture of our two countries. With some initiative, it is possible for the Malaysian schools to participate in the above projects and some research into the pedagogical and learning effects can be conducted.

In order for technology to have the impact on educational research, however, a number of issues need to be addressed. Mashhadi and Han (1996: 7) mentioned the issues of access, IT skills, and a deeper understanding of the tools of communication on the Net.

Recommendations for design of and future research on distance education

Instructional design

In even a simulation or virtual learning environment there are fundamental assumptions underlying the world view(s) being promoted either explicitly or implicitly. An essential metacognitive skill that students need to develop is to understand the nature of virtual learning environments and not simply to become fluent in their use. Bearing in mind the importance of experiential learning, and that learning is culturally bound, instruction at a distance should ultimately only be a component of a course. 'Face-to-face' communication remains the most efficient and powerful form of communication.

In recent research on Reflection Online During the Practicum (Harkrider and Chen, 1998), it is found that Web-based learning or research, in fact, requires more structure in the design than classroom research. This is to ensure equity of opportunity for dialogue among participants in terms of their roles, time, and space. To avoid

potential problems, it is important to establish ground rules and negotiate for agreements about task-based or topic-based collaborative communication and web-based learning. The importance of clear and precise structures, even an open structure, as pre-conditions in the design for learning or for research cannot be overly emphasised. As far as it is possible, the significant elements of instructional design for distance learning such as accessibility, inter-connectivity, immediacy, interactivity and integration should be considered and incorporated into the design of courses.

The interpretation of information and the generation of knowledge will be dependent on the existing conceptual frameworks of the learner, frameworks which will be culturally mediated. The particular metaphors underlying concepts (e.g. electronic calculator versus electronic brain) serve to stimulate or limit the human imagination. The success of the marriage of technology and the culturally mediated ways in which technology is perceived will in the end determine the success of telematic courses.

Future research

Following a comprehensive review on distance education, McIsaac and Gunawardena (1996: 41) recommended that future research should:

- Move beyond media comparison studies
- Examine the characteristics of the distance learner and investigate the collaborative effects of media attributes and cognition
- Explore the relationship between media and the socio-cultural construction of knowledge
- Identify course design elements effective in interactive learning systems
- Contribute to a shared international research database
- Examine the cultural effects of technology and courseware transfer in distance education programmes.

In order for technology to have the impact on educational research that it, arguably, should have Mashhadi and Han (1996: 7) point out that a number of issues need to be addressed:

1. Equitable access to the on-ramps leading to the information highway (i.e. anywhere, anytime access to the Internet).
2. Universal access to the computers needed to travel on the information highway.

3. Worthwhile places or web-sites to explore (i.e. there are an enormous number of web-sites, but quantity does not necessarily assure quality).
4. Developing the necessary information retrieval skills among both faculty staff and research students.
5. Understanding how the tools of the communication age can be used to build the future, and not simply reproduce the past.

Much of the published research on electronic distance learning has been descriptions of the implementation of technology, and an analysis of what works and what does not. As Windschitl (1998: 28) points out:

> The literature stops short of asking critical questions such as, "Are these practices helping students, and, if so, how?" or, "How is the introduction of this technology changing pedagogical practices?".

These questions should be first addressed even as we consider the challenges in designing and researching distance learning environments and communities.

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